



2022 AI 학습 데이터 활용 해커톤

아이럽SLP 이해영



데이터셋 분석

44개 언어권 사용자 544명 한국어 음성 데이터
→ 음소 오류 분석 결과 7875개 최종 dataset

	file	speaker	sex	age	nationality	level	code	type	ref	ans	rec
0	0006965	0037	F	1	German	B	RS004	S	저는 지금 음료를 사러 갔다 와야 돼요	J E O N E U N J I G E U M E U M N I O S U A G O G G ...	J E O N E U N J I G E U M E U M N I O S U A G O G G ...
1	0006969	0037	F	1	German	B	RS008	S	일 년 전 우리가 한국 말을 어떻게 했는지 생각해 보세요	I L N I E O N J E O N U R I G A H A N G U N G M A ...	I L N I E O N J E O N U R I G A H A N G U N G M A ...
2	0006973	0037	F	1	German	B	RS011	S	얼굴이 안 좋은데 무슨 일 있어요	E O L G U R I A N J O E U N D E M U S E U N I L I ...	E O L G U R I A N J O E U N D E M U S E U N I L I ...
3	0006993	0037	F	1	German	B	RS051	S	창문이 열렸네요 닫아 주세요	C H h A N G M U N I I E O L L I E O N N E I O D A D A ...	C H h A N G M U N I I E O L L I E O N N E I O D A D A ...
4	0006932	0037	F	1	German	B	RW128	W	궁리	G U N G N I	G U N G M I N
...
7870	0243952	999	F	89	Indonesian	B	RS074	S	오늘 다섯시에 퇴근하지	O N E U L D A S E O T S I E T h O E G E U N A J I	O N E U L D A S E O T S I E T h O E G E U N A J I
7871	0232859	999	F	89	Indonesian	B	RW013	W	키	K h I	G U I
7872	0233061	999	F	89	Indonesian	B	RW054	W	수리	S U R I	S O R I
7873	0233120	999	F	89	Indonesian	B	RW073	W	사의	S A e u l	S A E
7874	0233184	999	F	89	Indonesian	B	RW091	W	부엌	B U E O K h	J U E O K h

정해진 단락 읽기 (RPxxx)	4개 단락
정해진 문장 읽기 (RSxxx)	75개 문장
정해진 단어 읽기 (RWxxx)	150개 단어

파일 이름 규칙 : 0088-M-87-ID-B-RW046-0031253.wav

- 0088 : 발화자 ID (88번 화자)
- M : 성별 (M : 남성, F : 여성)
- 87 : 출생년도 끝 2자리
- ID : 국적 코드 (Indonesian)
- B : 난이도 (B : 초급, A : 중고급)
- RW046 : 문장코드 (46번 단어 따라 읽기)
 - 문장의 경우 RS001~RS075
- 0031253 : 녹음 파일 ID

- 성별
- 연령
- 국적
- 발화 난이도
- 단락 / 문장 / 단어

- Kaldi 툴킷 사용하여 utterance 별 C, S, I, D 얻기

[illegible]

데이터셋 분석

speaker	sex	age	nationality	level	code	type	ref	ans	rec	count	C	S	I	D	error	per
0037	F	1	German	B	RS004	S	저는 지금 음료수하고 꽃을 사러 갔다 와야 돼요	J E O N E U N J I G E U M E U M N I O S U A G O G G ...	J E O N E U N J I G E U M E U M N I O S U A G O G G ...	{'C': 37, 'S': 1}	37	1	0	0	substitution of < O > to < EU >	0.014563
0037	F	1	German	B	RS008	S	일 년 전 우 리가 한국 말을 어떻게 했는지 생각 나세요	I L N I E O N J E O N U R I G A H A N G U N G M A ...	I L N I E O N J E O N U R I G A H A N G U N G M A ...	{'C': 48, 'I': 3}	48	0	3	0	insertion of < E >, insertion of < H > , insert...	0.048507
0037	F	1	German	B	RS011	S	얼굴이 안 좋은데 아무 튼 일 있어 요	E O L G U R I A N J O E U N D E M U S E U N I L I ...	E O L G U R I A N J O E U N D E M U S E U N I L I ...	{'C': 24, 'S': 1}	24	1	0	0	substitution of < I > > to < EO >	0.022727
0037	F	1	German	B	RS051	S	창문이 열 렸네요 달 아 주세요	C H h A N G M U N I I E O L L I E O N N E I O D A D A ...	C H h A N G M U N I I E O L N E I O D A D A J U S E I O	{'C': 21, 'D': 3}	21	0	0	3	deletion of < L > , deletion of < IEO > , delet...	0.108527
0037	F	1	German	B	RW128	W	궁리	G U N G N I	G U N G M I N	{'C': 4, 'S': 1, 'I': 1}	4	1	1	0	substitution of < N > > to < M > , insertion of < ...	0.193548
...
999	F	89	Indonesian	B	RS074	S	오늘 다섯 시에 퇴근 하지	O N E U L D A S E O t S I E Th O E G E U N A J I	O N E U L D A S E O t S I E Th O E Th G E U N A J I	{'C': 20, 'I': 1}	20	0	1	0	insertion of < Th >	0.045045
999	F	89	Indonesian	B	RW013	W	키	Kh i	G U I	{'S': 2}	0	2	0	0	substitution of < Kh > > to < G > , substitution ...	0.363636
999	F	89	Indonesian	B	RW054	W	수리	S U R I	S O R I	{'C': 3, 'S': 1}	3	1	0	0	substitution of < U > > to < O >	0.050000
999	F	89	Indonesian	B	RW073	W	사의	S A eul	S A E	{'C': 2, 'S': 1}	2	1	0	0	substitution of < eul > > to < E >	0.176471
999	F	89	Indonesian	B	RW091	W	부엌	B U E O Kh	J U E O Kh	{'S': 1, 'C': 3}	3	1	0	0	substitution of < B > > to < J >	0.045455

- 발화별 correct, substitution, insertion, deletion 개수 항목 추가
- 세부적으로 어떤 발음 오류가 있었는지 error detail 항목 분석
- PER 계산

CSID 분석

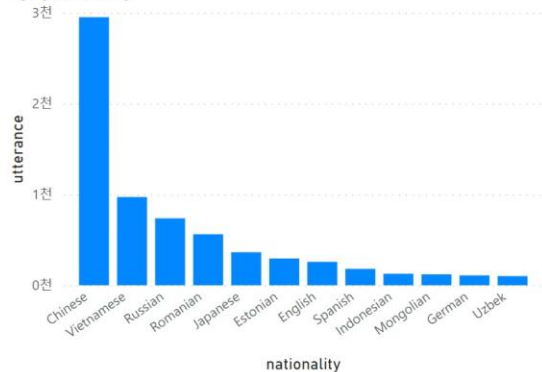
- 전체 국가 데이터셋 - 빈도 높은 오류 패턴 분석

```
1 deletion of < N > 3227
2 deletion of < A > 2722
3 deletion of < EU > 1848
4 deletion of < R > 1581
5 deletion of < I > 1565
6 deletion of < k > 1526
7 insertion of < N > 1324
8 deletion of < G > 1260
9 substitution of < O > to < EO > 1144
10 deletion of < L > 1026
11 substitution of < GG > to < G > 959
12 deletion of < H > 936
13 insertion of < A > 930
14 deletion of < O > 905
15 deletion of < t > 893
16 deletion of < E > 876
17 deletion of < D > 832
18 deletion of < EO > 779
19 deletion of < U > 768
20 deletion of < J > 763
21 deletion of < S > 691
22 deletion of < NG > 690
23 deletion of < M > 683
24 insertion of < I > 654
25 deletion of < B > 622
26 insertion of < G > 518
27 insertion of < M > 503
28 insertion of < EU > 486
29 insertion of < EO > 465
30 substitution of < U > to < O > 454
31 insertion of < L > 452
32 substitution of < NG > to < N > 451
33 deletion of < iO > 417
34 substitution of < N > to < L > 397
35 substitution of < O > to < U > 393
36 substitution of < A > to < EO > 375
37 deletion of < eul > 374
38 substitution of < eul > to < E > 352
39 insertion of < S > 340
40 substitution of < R > to < L > 329
41 insertion of < J > 305
42 insertion of < E > 284
43 substitution of < CHh > to < J > 284
44 substitution of < G > to < Kh > 278
45 deletion of < Th > 275
```

데이터셋 분석

(영상 재생)

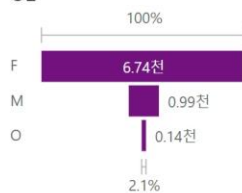
국가별 data 수



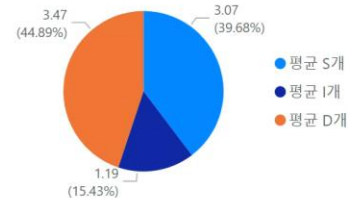
데이터 수

7875

성별



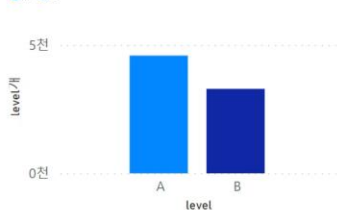
SCID



37.85
평균 C개
3.07
평균 S개
1.19
평균 I개
3.47
평균 D개
0.16
평균 per개

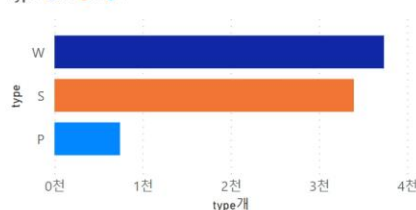
난이도

● A ● B



단락 / 문장 / 단어

type ● W ● S ● P



error

deletion of < I >
deletion of < iO >
deletion of < L >
deletion of < M >
deletion of < N >
deletion of < NG >
insertion of < A >
insertion of < G >
insertion of < I >
insertion of < iEO >
insertion of < k >
insertion of < L >
insertion of < M >
insertion of < N >
insertion of < NG >
substitution of < B > to < D >
substitution of < O > to < U >

error

deletion of < A >, deletion of
< D >, deletion of < t >
deletion of < A >, deletion of
< EU >, substitution of < M >
to < O >
deletion of < A >, deletion of
< eul >, insertion of < J >,
insertion of < EO >, insertion
of < N >, insertion of < A >,
insertion of < A >
deletion of < A >, deletion of
< G >, deletion of < E >
deletion of < A >, deletion of
< G >, insertion of < A >,
insertion of < S >
deletion of < A >, deletion of
< G >, substitution of < N >
to < EU >
deletion of < A >, deletion of

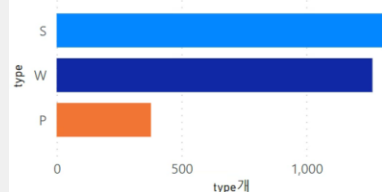
Chinese

(영상 재생)

Chinese

단락 / 문장 / 단어

type ● S ● W ● P



error

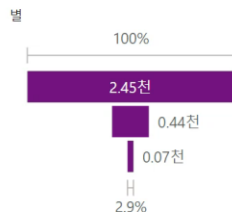
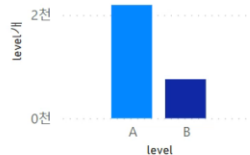
deletion of < EO >
deletion of < I >
deletion of < iO >
deletion of < k >, substitution of < GG > to < G >,
deletion of < k >
deletion of < L >
deletion of < M >
deletion of < N >
deletion of < NG >
insertion of < A >
insertion of < EO >
insertion of < EU >
insertion of < G >
insertion of < L >

데이터 수

2951

난이도

level ● A ● B



PER

0.16

가을
ref

가을
ref

가을
ref

가을
ref

가을
ref

B A Kh EU
rec

D A EU M
rec

G A B U GG
rec

G A EU L G L
rec

G A L L
rec

G A EU L
ans

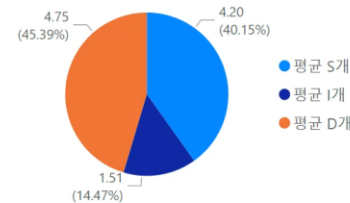
G A EU L
ans

G A EU L
ans

G A EU L
ans

G A EU L
ans

SCID



● 평균 S개
● 평균 W개
● 평균 P개

47.26
평균 C개
4.20
평균 S개
1.51
평균 W개
4.75
평균 P개
0.16
평균 per개

English

(영상 재생)



Spanish

(영상 재생)



외국인 학습자의 한국어 발음 오류 패턴 제시

- Chinese / Spanish / English 국가 한국어 발음 오류 패턴 제시

→ 모국어 영향에 따른 음소 단위의 치환(substitution), 삭제(deletion), 삽입(insertion) 오류 패턴 분석

Chinese

1	deletion of < N > 1922
2	deletion of < A > 1474
3	deletion of < EU > 993
4	deletion of < k > 962
5	deletion of < R > 940
6	deletion of < l > 697
7	substitution of < O > to < EO > 691
8	insertion of < N > 652
9	substitution of < GG > to < G > 617
10	deletion of < G > 613
11	deletion of < O > 535
12	deletion of < H > 503
13	deletion of < t > 487
14	insertion of < A > 461
15	deletion of < E > 409
16	deletion of < L > 401
17	deletion of < D > 390
18	deletion of < U > 368
19	deletion of < J > 363
20	deletion of < NG > 349
21	deletion of < S > 303
22	insertion of < l > 292
23	deletion of < M > 292
24	deletion of < EO > 279
25	deletion of < B > 255
26	insertion of < M > 251
27	insertion of < G > 236
28	insertion of < EU > 231
29	insertion of < EO > 229
30	insertion of < L > 224

English

1	deletion of < A > 52
2	insertion of < N > 50
3	deletion of < L > 47
4	deletion of < N > 46
5	deletion of < l > 41
6	deletion of < R > 36
7	deletion of < EU > 36
8	deletion of < k > 30
9	insertion of < A > 25
10	deletion of < D > 22
11	insertion of < EU > 20
12	substitution of < O > to < EO > 19
13	deletion of < EO > 19
14	insertion of < l > 18
15	deletion of < G > 18
16	deletion of < t > 17
17	deletion of < E > 16
18	deletion of < O > 16
19	deletion of < M > 15
20	deletion of < H > 15
21	deletion of < B > 15
22	insertion of < G > 14
23	insertion of < L > 14
24	insertion of < M > 14
25	deletion of < U > 14
26	substitution of < GG > to < G > 14
27	insertion of < EO > 13
28	substitution of < N > to < L > 13
29	deletion of < J > 13
30	insertion of < S > 12

Spanish

1	deletion of < N > 75
2	deletion of < A > 51
3	deletion of < EU > 47
4	substitution of < O > to < EO > 39
5	deletion of < R > 34
6	deletion of < l > 29
7	deletion of < G > 27
8	substitution of < GG > to < G > 26
9	deletion of < E > 26
10	deletion of < k > 25
11	deletion of < L > 23
12	insertion of < N > 23
13	deletion of < t > 23
14	deletion of < H > 20
15	deletion of < D > 20
16	deletion of < NG > 19
17	deletion of < J > 16
18	substitution of < NG > to < N > 16
19	deletion of < O > 16
20	deletion of < B > 15
21	deletion of < U > 14
22	substitution of < G > to < Kh > 14
23	insertion of < EU > 13
24	deletion of < EO > 13
25	deletion of < S > 13
26	deletion of < M > 13
27	deletion of < iO > 11
28	substitution of < U > to < O > 11
29	substitution of < J > to < S > 10
30	insertion of < A > 10

외국인 학습자의 한국어 발음 오류 패턴 제시

- < N > : English 만 deletion of <N> 의 오류 빈도가 낮음.
- 오히려 insertion of <N> 의 오류 패턴이 더 자주 발견됨.

전체

```
1 deletion of < N > 3227
2 deletion of < A > 2722
3 deletion of < EU > 1848
4 deletion of < R > 1581
5 deletion of < I > 1565
6 deletion of < k > 1526
7 Insertion of < N > 132
8 deletion of < G > 1260
9 substitution of < O > to < EO > 1144
10 deletion of < L > 1026
11 substitution of < GG > to < G > 959
12 deletion of < H > 936
13 insertion of < A > 930
14 deletion of < O > 905
15 deletion of < t > 893
16 deletion of < E > 876
17 deletion of < D > 832
18 deletion of < EO > 779
19 deletion of < U > 768
20 deletion of < J > 763
21 deletion of < S > 691
22 deletion of < NG > 690
23 deletion of < M > 683
24 insertion of < I > 654
25 deletion of < B > 622
26 insertion of < G > 518
27 insertion of < M > 503
28 insertion of < EU > 486
29 insertion of < EO > 465
30 substitution of < U > to < O > 454
31 insertion of < L > 452
32 substitution of < NG > to < N > 451
33 deletion of < iO > 417
34 substitution of < N > to < L > 397
35 substitution of < O > to < U > 393
36 substitution of < A > to < EO > 375
37 deletion of < eul > 374
38 substitution of < eul > to < E > 352
39 insertion of < S > 340
40 substitution of < R > to < L > 329
```

Chinese

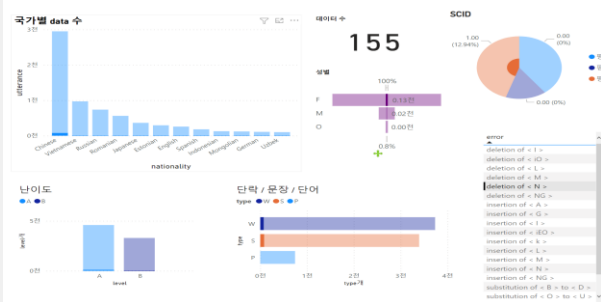
```
1 deletion of < N > 1922
2 deletion of < A > 1474
3 deletion of < EU > 993
4 deletion of < k > 962
5 deletion of < R > 940
6 deletion of < I > 697
7 substitution of < O > to < EO > 691
8 insertion of < N > 652
9 substitution of < GG > to < G > 617
10 deletion of < G > 613
11 deletion of < O > 535
12 deletion of < H > 503
13 deletion of < t > 487
14 insertion of < A > 461
15 deletion of < E > 409
16 deletion of < L > 401
17 deletion of < D > 390
18 deletion of < U > 368
19 deletion of < J > 363
20 deletion of < NG > 349
21 deletion of < S > 303
22 insertion of < I > 292
23 deletion of < M > 292
24 deletion of < EO > 279
25 deletion of < B > 255
26 insertion of < M > 251
27 insertion of < G > 236
28 insertion of < EU > 231
29 insertion of < EO > 229
30 insertion of < L > 224
```

English

```
1 deletion of < A > 52
2 insertion of < N > 50
3 deletion of < L > 47
4 deletion of < N > 46
5 deletion of < t > 41
6 deletion of < R > 36
7 deletion of < EU > 36
8 deletion of < k > 30
9 insertion of < A > 25
10 deletion of < D > 22
11 insertion of < EU > 20
12 substitution of < O > to < EO > 19
13 deletion of < EO > 19
14 insertion of < I > 18
15 deletion of < G > 18
16 deletion of < t > 17
17 deletion of < E > 16
18 deletion of < O > 16
19 deletion of < M > 15
20 deletion of < H > 15
21 deletion of < B > 15
22 insertion of < G > 14
23 insertion of < L > 14
24 insertion of < M > 14
25 deletion of < U > 14
26 substitution of < GG > to < G > 14
27 insertion of < EO > 13
28 substitution of < N > to < L > 13
29 deletion of < J > 13
30 insertion of < S > 12
```

Spanish

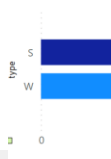
```
1 deletion of < N > 75
2 deletion of < A > 51
3 deletion of < EU > 47
4 substitution of < O > to < EO > 39
5 deletion of < R > 34
6 deletion of < I > 29
7 deletion of < G > 27
8 substitution of < GG > to < G > 26
9 deletion of < E > 26
10 deletion of < k > 25
11 deletion of < L > 23
12 insertion of < N > 23
13 deletion of < t > 23
14 deletion of < H > 20
15 deletion of < D > 20
16 deletion of < NG > 19
17 deletion of < J > 16
18 substitution of < NG > to < N > 16
19 deletion of < O > 16
20 deletion of < B > 15
21 deletion of < U > 14
22 substitution of < G > to < Kh > 14
23 insertion of < EU > 13
24 deletion of < EO > 13
25 deletion of < S > 13
26 deletion of < M > 13
27 deletion of < iO > 11
28 substitution of < U > to < O > 11
29 substitution of < J > to < S > 10
30 insertion of < A > 10
```



English

단락 / 문장 / 단어

type S W



0.13

데이터 수

성별

type F M



나이도

level A B



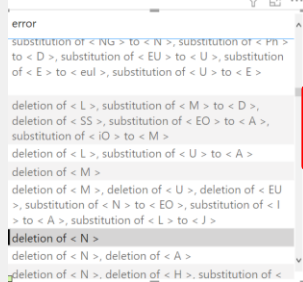
SCID

level A B



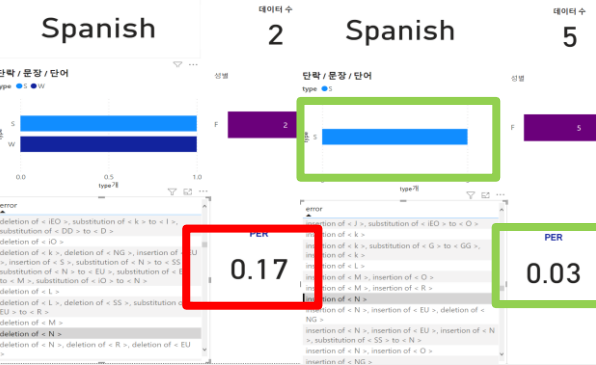
● 평균 D개
● 평균 1개
● 평균 S개

35.50
평균 C개
0.00
평균 S개
0.00
평균 1개
1.00
평균 D개
0.06
평균 per개



PER

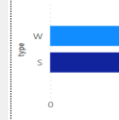
국내선 공항과 국제선 공항이 ...	G U N G N E S E O N G O N G H...	G U N G N E S E O N G O N G H A...
ref	rec	ans
권력과 공권력의 차이점이 뭐...	G u E O N I E O k G G o A G O N G...	G u E O N I E O k G G o A G O N G...
ref	rec	ans
새로 생긴 식당에 가 봤는데 분...	S E R O S E N G G I N S I k D D ...	S E R O S E N G G I N S I k D D A ...
ref	rec	ans
인류	I N I U	I N N I U
ref	rec	ans
줄넘기	J U N E O M G I	J U N N E O M G I
ref	rec	ans



English

단락 / 문장 / 단어

type W S



데이터 수

성별

type F M



나이도

level A B



SCID

level A B



● 평균 D개
● 평균 1개
● 평균 S개

18.00
평균 C개
0.00
평균 S개
1.00
평균 1개
0.00
평균 D개
0.10
평균 per개

PER

공리	G U N G N I N	G U N G N I
ref	rec	ans
무늬	M U N N eul	M U N eul
ref	rec	ans
물이 팔팔 끓는데 왜 불을 안 ...	M U R I P H A L P H A L G E U N ...	M U R I P H A L P H A L G E U N N E...
ref	rec	ans
새로 생긴 식당에 가 봤는데 분...	S E R O S E N G G I N S I k D D ...	S E R O S E N G G I N S I k D D A ...
ref	rec	ans
새로 생긴 식당에 가 봤는데 분...	S E R O S E N G G I N S I k D D ...	S E R O S E N G G I N S I k D D A ...
ref	rec	ans

0.10

외국인 학습자의 한국어 발음 오류 패턴 제시

- < GG > : English 만 substitution of <GG> to <G> 의 오류 빈도가 다른 국가에 비해 비교적 낮음.
- 주로 deletion of <G> 와 substitution of <GG> to <G> 는 함께 나타나는 경우가 많은데, 영어만 조금 더 차이가 있음.

전체

1	deletion of < N > 3227
2	deletion of < A > 2722
3	deletion of < EU > 1848
4	deletion of < R > 1581
5	deletion of < I > 1565
6	deletion of < k > 1526
7	insertion of < N > 1324
8	deletion of < G > 1260
9	substitution of < O > to < EO > 1144
10	deletion of < L > 1026
11	substitution of < GG > to < G > 959
12	deletion of < H > 936
13	insertion of < A > 930
14	deletion of < O > 905
15	deletion of < t > 893
16	deletion of < E > 876
17	deletion of < D > 832
18	deletion of < EO > 779
19	deletion of < U > 768
20	deletion of < J > 763
21	deletion of < S > 691
22	deletion of < NG > 690
23	deletion of < M > 683
24	insertion of < I > 654
25	deletion of < B > 622
26	insertion of < G > 518
27	insertion of < M > 503
28	insertion of < EU > 486
29	insertion of < EO > 465
30	substitution of < U > to < O > 454
31	insertion of < L > 452
32	substitution of < NG > to < N > 451
33	deletion of < iO > 417
34	substitution of < N > to < L > 397
35	substitution of < O > to < U > 393
36	substitution of < A > to < EO > 375
37	deletion of < eul > 374
38	substitution of < eul > to < E > 352
39	insertion of < S > 340
40	substitution of < R > to < L > 329

Chinese

1	deletion of < N > 1922
2	deletion of < A > 1474
3	deletion of < EU > 993
4	deletion of < k > 962
5	deletion of < R > 940
6	deletion of < I > 697
7	substitution of < O > to < EO > 691
8	insertion of < N > 652
9	substitution of < GG > to < G > 617
10	deletion of < G > 613
11	deletion of < O > 535
12	deletion of < H > 503
13	deletion of < t > 487
14	insertion of < A > 461
15	deletion of < E > 409
16	deletion of < L > 401
17	deletion of < D > 390
18	deletion of < U > 368
19	deletion of < J > 363
20	deletion of < NG > 349
21	deletion of < S > 303
22	insertion of < I > 292
23	deletion of < M > 292
24	deletion of < EO > 279
25	deletion of < B > 255
26	insertion of < M > 251
27	insertion of < G > 236
28	insertion of < EU > 231
29	insertion of < EO > 229
30	insertion of < L > 224

English

1	deletion of < A > 52
2	insertion of < N > 50
3	deletion of < L > 47
4	deletion of < N > 46
5	deletion of < I > 41
6	deletion of < R > 36
7	deletion of < EU > 36
8	deletion of < k > 30
9	insertion of < A > 25
10	deletion of < D > 22
11	insertion of < EU > 20
12	substitution of < O > to < EO > 19
13	deletion of < EO > 19
14	insertion of < I > 18
15	deletion of < G > 18
16	deletion of < t > 17
17	deletion of < E > 16
18	deletion of < O > 16
19	deletion of < M > 15
20	deletion of < H > 15
21	deletion of < B > 15
22	insertion of < G > 14
23	insertion of < L > 14
24	insertion of < M > 14
25	deletion of < U > 14
26	substitution of < GG > to < G > 14
27	insertion of < EO > 13
28	substitution of < N > to < L > 13
29	deletion of < J > 13
30	insertion of < S > 12

Spanish

1	deletion of < N > 75
2	deletion of < A > 51
3	deletion of < EU > 47
4	substitution of < O > to < EO > 39
5	deletion of < R > 34
6	deletion of < I > 29
7	deletion of < G > 27
8	substitution of < GG > to < G > 26
9	deletion of < E > 26
10	deletion of < k > 25
11	deletion of < L > 23
12	insertion of < N > 23
13	deletion of < t > 23
14	deletion of < H > 20
15	deletion of < D > 20
16	deletion of < NG > 19
17	deletion of < J > 16
18	substitution of < NG > to < N > 16
19	deletion of < O > 16
20	deletion of < B > 15
21	deletion of < U > 14
22	substitution of < G > to < Kh > 14
23	insertion of < EU > 13
24	deletion of < EO > 13
25	deletion of < S > 13
26	deletion of < M > 13
27	deletion of < iO > 11
28	substitution of < U > to < O > 11
29	substitution of < J > to < S > 10
30	insertion of < A > 10

외국인 학습자의 한국어 발음 오류 패턴 제시

- < M > : Spanish 만 insertion of <M> 의 오류 빈도가 낮음 (상위 랭크에 빠져 있음)

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감사합니다.